



Software Engineering

Lecture 1 – Gantt Charts

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Estimating Project Size And Complexity

- Very difficult to do, but needed often
- Basic process
 - 1) Estimate the **size** of the product
 - 2) Estimate the **effort** (person-months)
 - 3) **Estimate the schedule**
- NOTE: Not all of these steps are always explicitly performed



Duration

- What is the duration?

The duration of a project is the elapsed time in business working days, not including weekends, holidays, or other nonworking days.

- Duration is different from work effort.

- Work effort is labor required to **complete an activity**. That labor can be consecutive or nonconsecutive hours.
- Duration is work effort divided by number of people doing the work
- Or, work effort is the duration multiplied by the number of people doing the work
- E.g. five people reviewing a document; the duration may be 10 hours but the work effort is 50 staff-hours



Schedule Development - Definition

- Schedule development is the culmination of the other Project Time Management processes we have discussed:
 - Activity definition
 - Activity sequencing
 - Activity resource estimating
 - Activity duration estimating
- It is an iterative process to determine planned start and finish dates for activities
- It is a continuous process throughout project, addressing approved changes and risks



Network Analysis

- *Network analysis* is the technique that generates the project schedule
- Network analysis may use several different analysis methods to calculate the early and late start dates for project activities. These methods may be combined and include:
 - **Gantt Charts**
 - **Critical Path Method (CPM)**
 - Critical Chain Method (CCM)
 - What-if analysis
 - Resource leveling

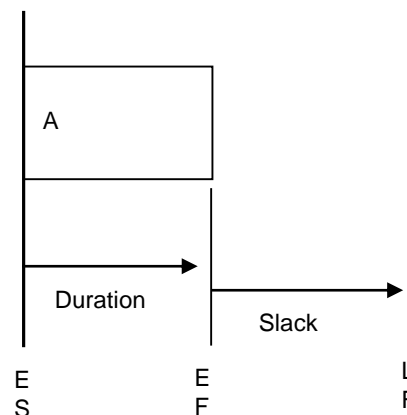


Network Analysis Terminology

- **Activity.** An activity always consumes time and may also consume resources. I use task and activity equivalently
- **Critical.** A critical activity or event is one that must be achieved by a certain time, having no latitude (slack or float)
- **Critical path.** The critical path is the longest path through a project network. Because it has no slack, all activities on the critical path must be completed as scheduled, or the end date will slip
- **Events.** Beginning and ending points of activities are known as events. An event is a specific point in time
- **Milestone.** An event representing a point in a project of special significance. Usually the completion of a major phase of the work. Project reviews are often conducted at milestones

Slack Time

- Slack time, also known as float, is the amount of delay expressed in units of time that could be tolerated in the starting time or completion time of an activity without causing a delay in the completion of the project.
- Slack time is the difference between the **late finish** and the **early finish** (LF-EF). If the result is greater than zero, then the activity has a range of time in which it can start and finish without delaying the project completion date, as shown in the figure below:





Slack Time

- If an activity has zero slack, it determines the project completion date. In other words, all the activities on the critical path must be done on their earliest schedule or the project completion date will suffer.
- If an activity with total slack greater than zero were to be delayed beyond its late finish date, it would become a critical path activity and cause the completion date to be delayed.
- The sequence of activities that has zero slack is defined as the critical path
- In general, the critical path is the path that has minimum slack.



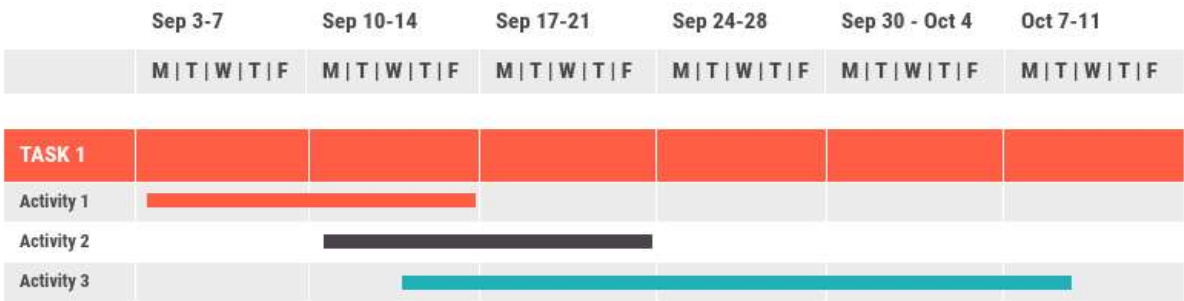
GANTT Charts - Definition

- one of the most popular and useful ways in project management
- Gantt chart shows you what has to be done (the activities) and when (the schedule).
- showing activities (tasks or events) displayed against time
- the position and length of the bar reflects the start date, duration and end date of the activity.

FUEL ADVERTISING

Client ID: 10-607

Project Status



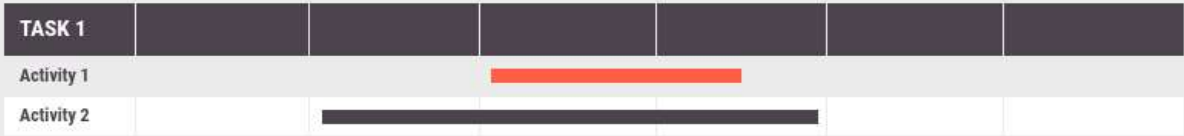
Sonya J.



Petrov K.



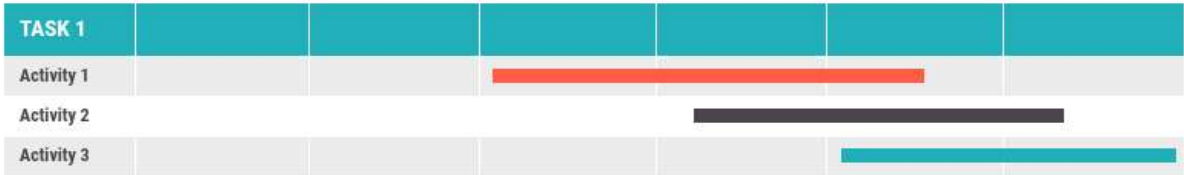
Heather B.



Amir K.



Tony P.



Julia F.



Petrov K.



Mark R.



GANTT Charts - characteristics

- The bar in each row identifies the corresponding task
- The horizontal position of the bar identifies start and end times of the task
- Bar length represents the duration of the task
- Task durations can be compared easily
- Good for allocating resources and re-scheduling
- Precedence relationships can be represented using arrows
- Critical activities are usually highlighted
- Slack times are represented using bars with dotted lines
- The bar of each activity begins at the activity earliest start time (ES)
- The bar of each activity ends at the activity latest finish time (LF).



GANTT Charts - Purpose

- What the various activities are
- When each activity begins and ends
- How long each activity is scheduled to last
- Where activities overlap with other activities, and by how much
- The start and end date of the whole project



GANTT Charts Pros & Cons

Advantages

- Simple
- Good visual communication to others
- Task durations can be compared easily
- Good for scheduling resources

Disadvantages

- Dependencies are more difficult to visualize
- Minor changes in data can cause major changes in the chart

GANTT Charts – Creation Steps



1. Identify the tasks to be scheduled
2. Determine the durations of each task
3. List each task down the vertical axis of chart
 1. In general, list tasks to be performed first at the top and then move downward as the tasks will happen
4. Use horizontal axis for the dates
5. Determine start and finish dates for activities
 1. Consider which tasks must be completed or partially completed before the next task

GANTT Charts – Creation Steps

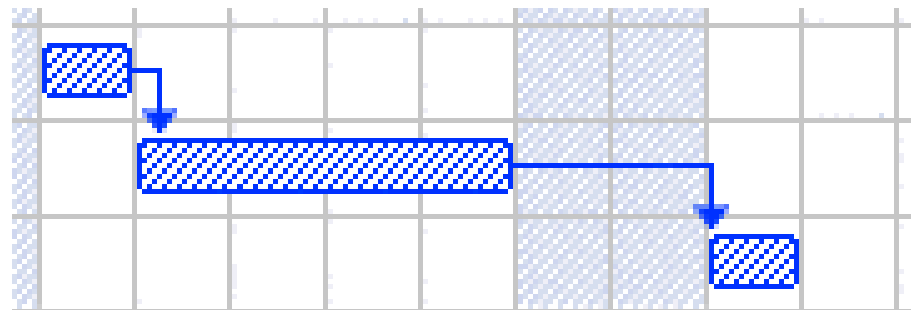


- To use the Gantt chart to report progress:
 - If the task has been completed, completely shade in the bar corresponding to the task
 - If the task has been partially completed, shade in the percentage of the bar that represents the percentage of the task that has been completed
 - Unshaded bars represents tasks that have not been started

GANTT Charts – Creation Steps

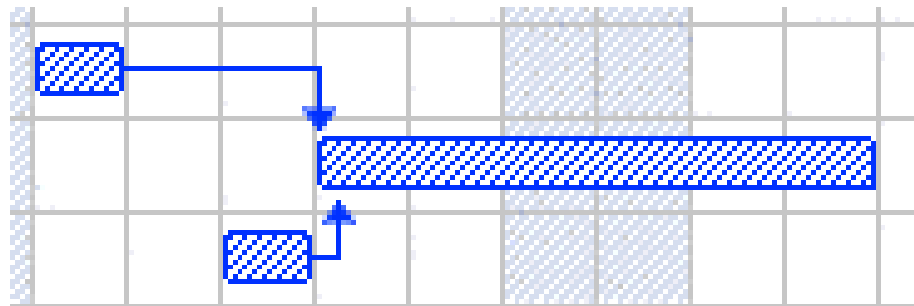
By default, tasks are usually linked in a 'Finish to Start' relationship (dependency), which means that the first task you select (the predecessor task) must end before the next task you select (the successor task) can start, and so on

The arrowhead indicates the direction of the link: it goes from the predecessor to the successor. (Gantt chart predecessors)



GANTT Charts – Creation Steps - **Gantt chart multiple predecessors**

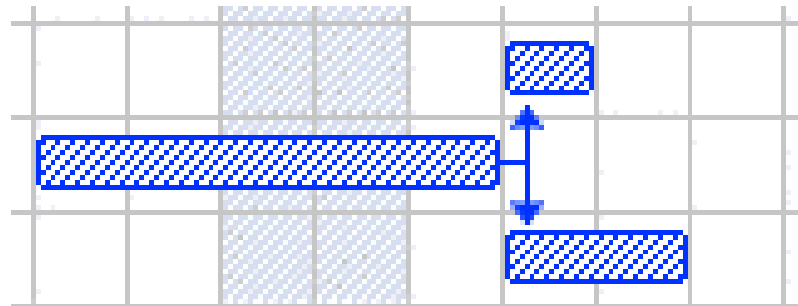
- A task can have more than one predecessor.
- In this case its start date is determined by the predecessor link that gives it the **latest start date**.
- As dates and times change the project, the predecessor link that determines the start date of the task may also change.



GANTT Charts – Creation Steps

Gantt chart successors

Similarly a task can have several successors. In this case the task determines the start date of all its successor tasks.



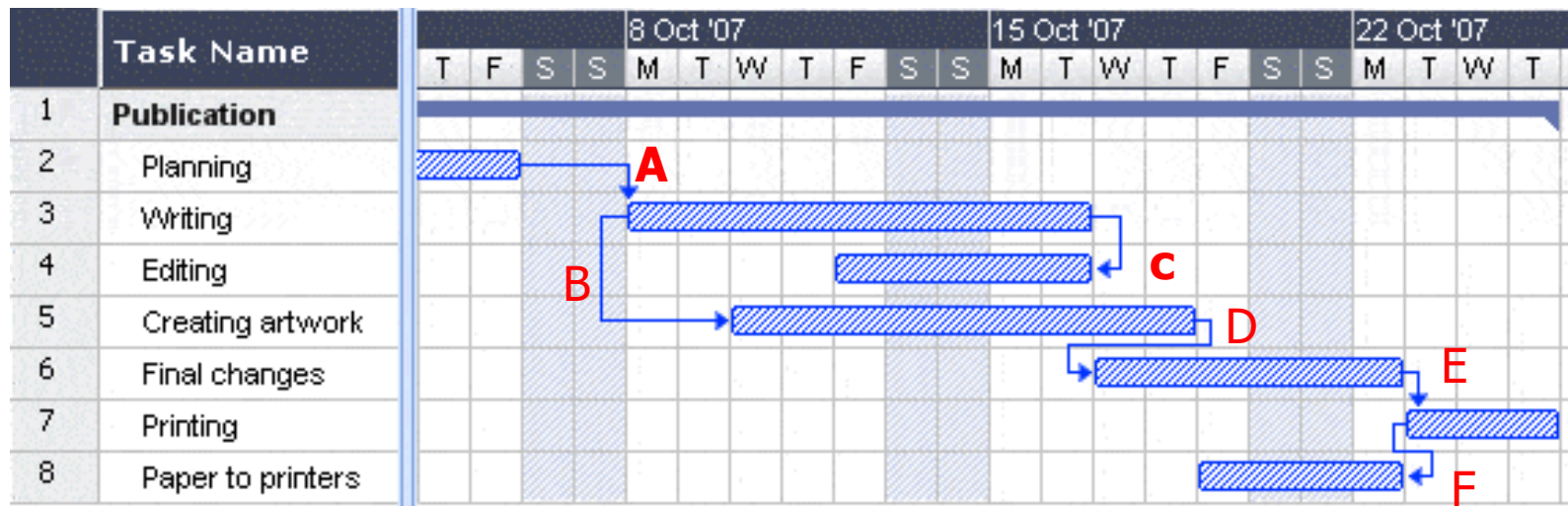


Link Types

- There are four possible relationships (dependencies) between tasks:
- **Finish to Start (FS) - the default:** The task cannot start before its predecessor ends, although it may start later.
- **Start to Start (SS):** The task cannot start until the predecessor starts, although it may start later. This can be useful if you have a task whose start date depends on the start date of another task.
- **Finish to Finish (FF):** The task cannot end before the predecessor ends, although it may end later.
- **Start to Finish (SF):** The task cannot end before the predecessor starts, although it may end later. This task relationship is rarely used.

Link Types

- The following project plan for the preparation of a publication illustrates all these kinds of relationships.



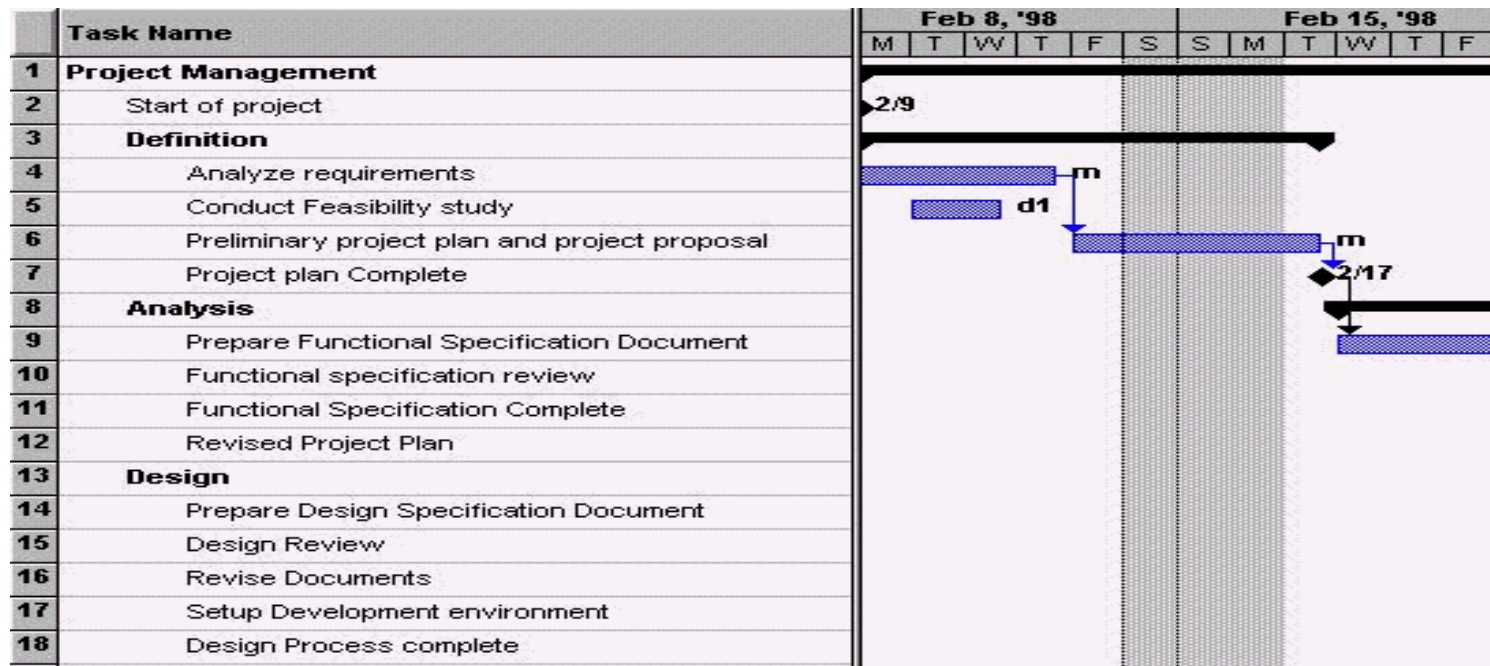
Determine FS, SS, FF , SF ??



GANTT Charts - Example

- The following table shows the tasks, dependencies, and estimated times a project manager might input to a basic GANTT chart for a software development project

GANTT Charts – Example 1





GANTT Charts – Example 2

Project Start Date = 12 June 2015

Task Identifier	Task Description	Predecessor Task(s)	Time (days)
1	Establish project	-	2
2	Establish customer requirements	1	3
3	Produce software specification documents	2	4
4	Write test plans	3	1
5	Write code	3	2
6	Developer testing	5	2
7	System testing	4,6	4
8	Write customer documentation	3	3

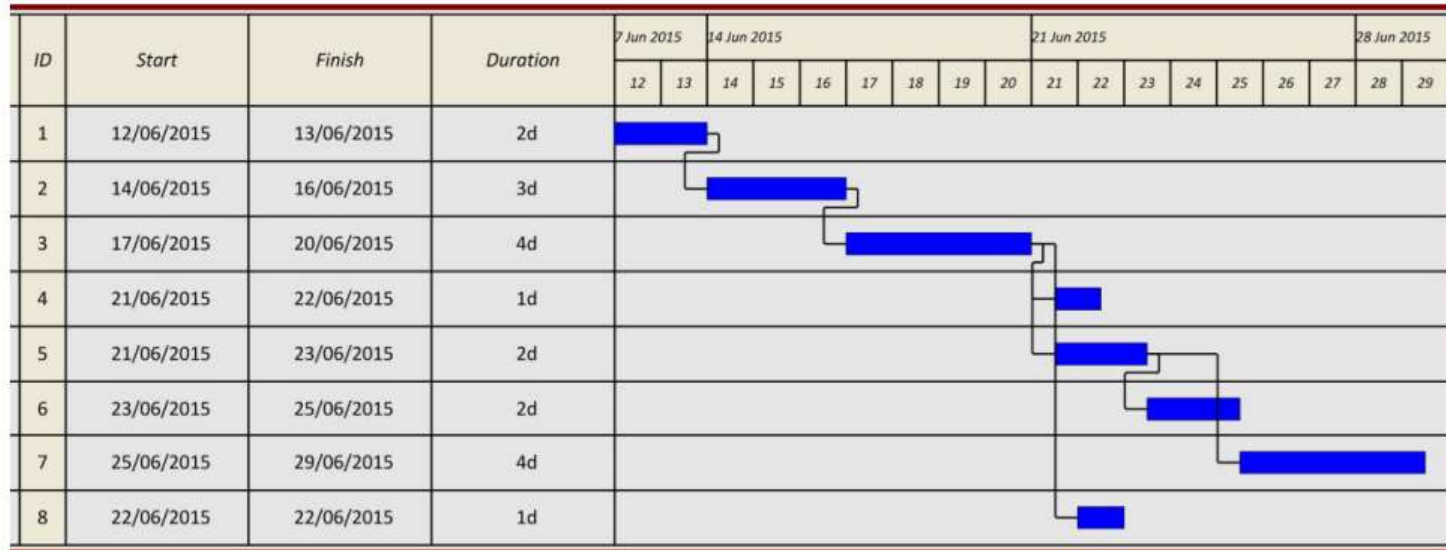
Draw Gantt chart for the previous tasks



GANTT Charts – Example 2

- Task 1 has no predecessors, and can thus start on 12 June. The GANTT chart shows the task as a box starting on 12 June and finishing on 13 June on the horizontal axis. Task 2 requires Task 1 to be completed, and the duration is three days, so the box covers the dates 14 to 16 June. The line from the finish of Task 1 to the start of Task 2 indicates the dependency. Note that Tasks 4, 5 and 8 all require Task 3 to be completed, and have no other dependencies, so these all start on the same date. The chart below shows all seven days of the week, but often, weekend days are excluded.

GANTT Charts – Example 2





Assignment

- Depending on the **previous data** in the previous example, (2 Marks)
 - draw the Gantt Chart using Excel
 - Add a sheet elaborating the steps to reach the final results
 - Upload your work to the following link:
https://drive.google.com/drive/folders/1WUigx7HAK_NkodBnnu6N5T14vkNwWccV?usp=sharing